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GREGG RIVER CBR TEST RESULTS

R. Whipple and R.J. Kolada

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GREGG RIVER CBR TEST RESULTS

by

R. Whipple and R.J. Kolada

ABSTRACT

The California Bearing Ratio Test, originally developed for highway design, can be used as an aid for mine haul road design. After pushing a piston into the ground at a constant rate, two force readings at two specific depths can be converted to pressures. From these pressures, ratios are calculated.

The field test results contained in this report are suspect because the difference between the two ratios for any one test was as much as thirty percent. Procedural error is the most likely reason for the unsuccessful results. The cranking rate will have to be adjusted to 18 revolutions per minute in an attempt to reduce the amount of error.

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RÉSULTATS DU CONTRÔLE DU RAPPORT DE PUISSANCE (CBR) EFFECTUÉ À GREGG RIVER

par

R. Whipple et R.J. Kolada

RÉSUMÉ

Le contrôle du rapport de puissance (CBR), qui au départ avait été développé pour la conception de routes, peut être utilisé comme aide pour la construction des réseaux routiers des mines.

Après avoir enfoncé un piston dans le sol à une vitesse constante, on fait deux lectures de contraintes à deux profondeurs déterminées. Les résultats des lectures peuvent ensuite être convertis de façon à donner les niveaux de pression. Les rapports peuvent être établis à partir des niveaux de pression indiqués.

Les résultats des essais sur le terrain qui sont présentés dans ce rapport sont douteux parce que dans chaque cas, l'écart entre les deux rapports était aussi élevée que 30 pour cent. Des erreurs dans la façon de procéder sont problablement la cause de ces piètres résultats. La vitesse de démarrage devra être réglée à 18 tours par minute si on veut réussir à obtenir des données plus exactes.

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1.0 INTRODUCTION

The California Bearing Ratio Test was originally developed as an aid in the design of asphalt surfaces for highways. It has been adopted by the mining industry, to assist in the design of mine haul roads. Its most common application is in the determination of subbase requirements for highways.

A plunger is pushed into the ground surface at a constant rate. At certain depths, the deflection of a steel alloy proving ring is recorded. These dial gauge readings are plotted against penetration depths. The two force readings at two specific depths are transformed to pressures, and ratios computed.

2.0 TEST PROCEDURE

The CBR procedure as used at the Gregg River Mine is summarized here:

1.) With the rolling resistance trailer parked, the front dolly jack was lowered until the lunette on the tongue of the trailer was no longer resting on the truck hitch.
2.) On each side near the rear of the trailer, 48 inch Jack-Alls (TM) were lowered until the wheels were almost clear of the ground surface.
3.) The mechanical jack and swivel head assembly were attached to the plate on the rear of the trailer. To this was attached the proving ring, sufficient lengths of rod and the penetration piston.
4.) A 4.54 kilogram circular surcharge weight was placed on the ground directly below the piston.
5.) The piston assembly was lowered through the hole in the weight until 5 divisions (or 0.02 MPa=3 p.s.i.) was noted on the dial gauge attached to the proving ring.
6.) Having lifted the surcharge weight, fine pieces of coal or haul road material were placed underneath to level the plate.

7.) The remaining slotted surcharge weights, 4.54 kg. and 9.07 kg. were then placed on the circular plate.

8.) A dial gauge was placed on the rod assembly and a datum bar below. This gauge would record the penetration depths.

9.) Each gauge was reset zero.

10.) Readings were taken from the dial load gauge at the following penetrations: 0, 0.64, 1.27, 1.90, 2.54, 3.18, 3.81, 4.44, 5.08, 5.72, 6.35, 6.98, 7.62, 8.26, 8.89, 9.52, 10.16, 11.43, and 12.70 millimetres.

11.) At a rate of 60 revolutions per minute, the piston penetrated 4.2 mm/min. (0.17 in./min.) Total cranking time averaged approximately 3 minutes. Penetration was continued to a depth of 12.7 mm. (0.5 in.) or, until the maximum permissible load for the ring had been attained or the rod assembly showed an excessive amount of bending.

12.) After disassembly of the equipment, the jacks lowered and the dolly wheel raised. The rolling resistance trailer was advanced a minimum of 0.61 metres and the above steps repeated.

Following the field testing, plots were made. Each graph had "Penetration" as the independent variable on the abscissa (x-axis) and "Dial Gauge Reading" along the ordinate axis. (The various plots are included in an Appendix at the end of this report.) With the exception of two plots, the curves are parabolic in shape. That is not to say, however, that dial readings vary as the square of the penetration. The scales along the axes are different. A tangent line is drawn from the straight portion of the curve to intersect the x-axis. This necessitates translation of the origin along the abscissa because of consolidation and compaction effects. At 0.1 inch (2.54 mm) and 0.2 inch (5.08 mm) depths, the deflections of the dial load gauge are correlated to values of force by means of computer printouts supplied by the manufacturer. Force is converted into pressure knowing the piston diameter. The calculated pressures are compared to standard pressures of 6.89 MPa (1000 p.s.i.) and 10.34 MPa (1500 p.s.i.). The two percentage values, or California Bearing Ratios should be similar. If the ratio at 10.34 MPa is greater, the test should be rerun.

3.0 TEST RESULTS

In total, nine California Bearing Ratio Tests were performed at the Gregg River Mine. On the first day (May 26,1987) two tests were done near the intersection of the LM2 Pit, PQ Pit and D5 Dump access roads, and the main coal haul road. The road surface is quite hard as it is the main intersection for all types of vehicle traffic in the mine. The 6,000 pound capacity proving ring PR-60 was used for the two tests at the intersection.

The first test was completed in approximately 2 minutes. At a penetration of 5.30 mm the test was suspended. The graph shows a very irregular type of curve (Test#1, May 26,1987). The construction of the tangent line is dubious. In addition, the 0.2 penetration was not reached prior to suspension of the test. Thus, the result of CBR(0.1) is invalid.

Four readings were recorded (Test#2, May 26,1987) before the hexagonal bolts in the proving ring sheared. The load of the piston was sufficient to raise the wheels off the ground causing the trailer to move sideways. The bending of the column was too great and the bolts which fasten the ring to the end pieces broke. The four readings were sufficient to obtain 0.1 and 0.2 penetration CBR ratios of 60% and 78%, respectively. The two ratios differ by 31 percent. Since the 0.2 CBR value is greater than the 0.1 value, the test results are considered invalid.

On May 27,1987 seven tests were made about midway along the present footwall of the LM2 Pit. The pit floor was covered with fine particles of coal which were used to level the circular surcharge weight. The small proving ring PR-20 was employed for this set of tests. The parabolic shape is characteristic of all seven plots [1]. The computations (included in Appendix C) yielded CBR(0.1) and CBR(0.2) values which range from 3.24% to 19.5%, and from 3.48% to 25.0% respectively. There is a typical difference of approximately 30 percent between the two CBR values for any particular test. One exception is the third test where CBR(0.1) is 3.24% and CBR(0.2)

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1. The original graphs have been digitized on the Calcomp 9000 Tablet, and plotted by the HP7550A Plotter. All plots from May 27, 1987 are in Appendix B.

is 3.48%, a difference of about 15 percent. Because the 0.2 penetration CBR values exceed the corresponding 0.1 values, the pit floor test results must be assumed to be invalid.

4.0 DISCUSSION AND RECOMMENDATIONS

The California Bearing Ratio tests performed at the Gregg River Mine cannot be used as valid data. It is not understood at this time why the 0.2 penetration CBR value must be less than or equal to the 0.1 value. The fact that the 0.2 pressure value is divided by 10.34 MPa, (whereas the 0.1 pressure value uses 6.89 MPa as a divisor) imposes a control on the test results. The calculated force at 0.2 penetration must not be 50% greater than the 0.1 force value. If it is, the test should be rerun. This implies invalidity of the test results.

The following changes are recommended for future testing, based on references from The American Society for Testing Materials (ASTM D1883-73) and Soiltest, Inc., Operation and Service Instructions. (The manual written by Soiltest, Inc. is appended to this report.)

More attention is required when clearing the site prior to testing. Clearing of all material to make a level pad is not recommended. Instead, only large pieces should be removed. Loading of the penetration piston is specified after the circular surcharge weight has been placed on the ground. A maximum of 0.069 MPa (10 p.s.i.) is stated. This pressure corresponds to 5 divisions for the small proving ring and 0 divisions for the large PR-60 ring. For the PR-60 proving ring, penetration of the piston to establish a seating load will be ceased when deflection of the dial load gauge is noted. Fine beach sand will not be used to level the circular weight. Available materials such as fine coal particles or gravel should suffice.

Specification 3.7 on page 1-3 of the operation manual states that a minimum of 30 lb. (13.6 kg.) of surcharge weight is required for testing. The purpose of surcharge loading is to simulate the load of overlying subbase material. The total amount of surcharge weight is defined by the density and thickness of subgrade material. In the future, operating personnel will be consulted for density and depth of subgrade material.

Should the operator be unfamiliar with these properties, 50 pounds (22.7 kg.) will be used.

The total time specified for penetration is 10 minutes. Expressed as a rate, this is equivalent to 1.27 mm/min. or 18 revolutions per minute on the low gear sprocket of the crank mechanism. This lower rate may cause less force to be exerted, indirectly reducing the slope of the dial reading versus penetration curve.

Calculations were performed to determine the maximum amount of load each proving ring could withstand before permanent deformation. The small proving ring (PR-20) was found to have a maximum dial reading of 1043 divisions before permanent deflection would occur. For the larger proving ring (PR-60), 805 divisions are permitted before permanent deformation will render the ring unsuitable. In addition, the maximum dial gauge reading which would indicate lifting of the trailer was calculated. The small proving ring has an insufficient capacity to cause lifting of the trailer, based on an assumed static load of 2,000 kilograms. Only 590 divisions are required when using the large ring to lift the trailer. This calculation is supported by the data reading of Test #2, May 26,1987 of 535 divisions which resulted in the breaking of the bolts.

Finally, it is recommended that a short computer program be written for use on the Computronic computer mounted in the towing vehicle. The program would simply store the raw dial readings and convert them into pressures via the supplied calibration equation and the measured piston diameter. Later, luxuries (contingent on the success of future CBR testing) would calculate the equation of the tangent line, shift the origin and determine the CBR(0.1) and CBR(0.2) values.

5.0 CONCLUSIONS

The California Bearing Ratio testing performed at the Gregg River Mine provided first hand experience of a popular test method. Careful attention to recommended procedures is required if reproducible results are desired. Because it is unlikely that one can achieve exact reproducibility, CBR test results will be considered valid if the CBR(0.2) value is within a 10% tolerance of the CBR(0.1) value. Thus, the test results obtained on this visit must be assumed invalid.

Personnel at mine sites will be asked for such information as subgrade depth and wet density for the purpose of determining surcharge loading.

The penetration time should be changed to 10 minutes from the present three minutes. The recommended cranking rate is 18 r.p.m. on the slower gear pin. It is hoped that this time extension will somehov reduce the amount of force on the penetration piston, thereby reducing the slope of the curve on a plot. This would in turn, cause the CBR(0.2) value to be more comparable to the lesser CBR(0.1) value.

A maximum of 1043 divisions can be deflected on the small proving ring. This maximum capacity is insufficient to cause raising of the trailer, based on an assumed static load of 2,000 kilograms on the Jack-Alls. For the large ring, 590 divisions would be sufficient to raise the vehicle off the ground. This condition is unsafe because the bolts in the ring can shear. Then the trailer would move sideways. The loading capacity of the ring is not a limiting factor.

User written computer software would reduce the amount of time spent processing data. A very simple program would save 30% of calculation time.

BIBLIOGRAPHY

1. Anonymous, Operation and Service Instructions (for California Bearing Ratio Apparatus Model No. CN-725), Soiltest Inc., Evanston, Illinois, U.S.A.

APPENDIX A

EMR (CANMET) ROLLING RESISTANCE PROJECT - CBR TEST DATASHEET

APPENDIX A

EMR (CANMET) ROLLING RESISTANCE PROJECT CBR TEST DATASHEET
CLIENT: Gregg River Resources Ltd. LOCATION: LM2 Pit Floor
DATE: 27-MAY-87 PROVING RING: PR-20 SERIAL NUMBER: 21801

DIAL GAUGE READINGS

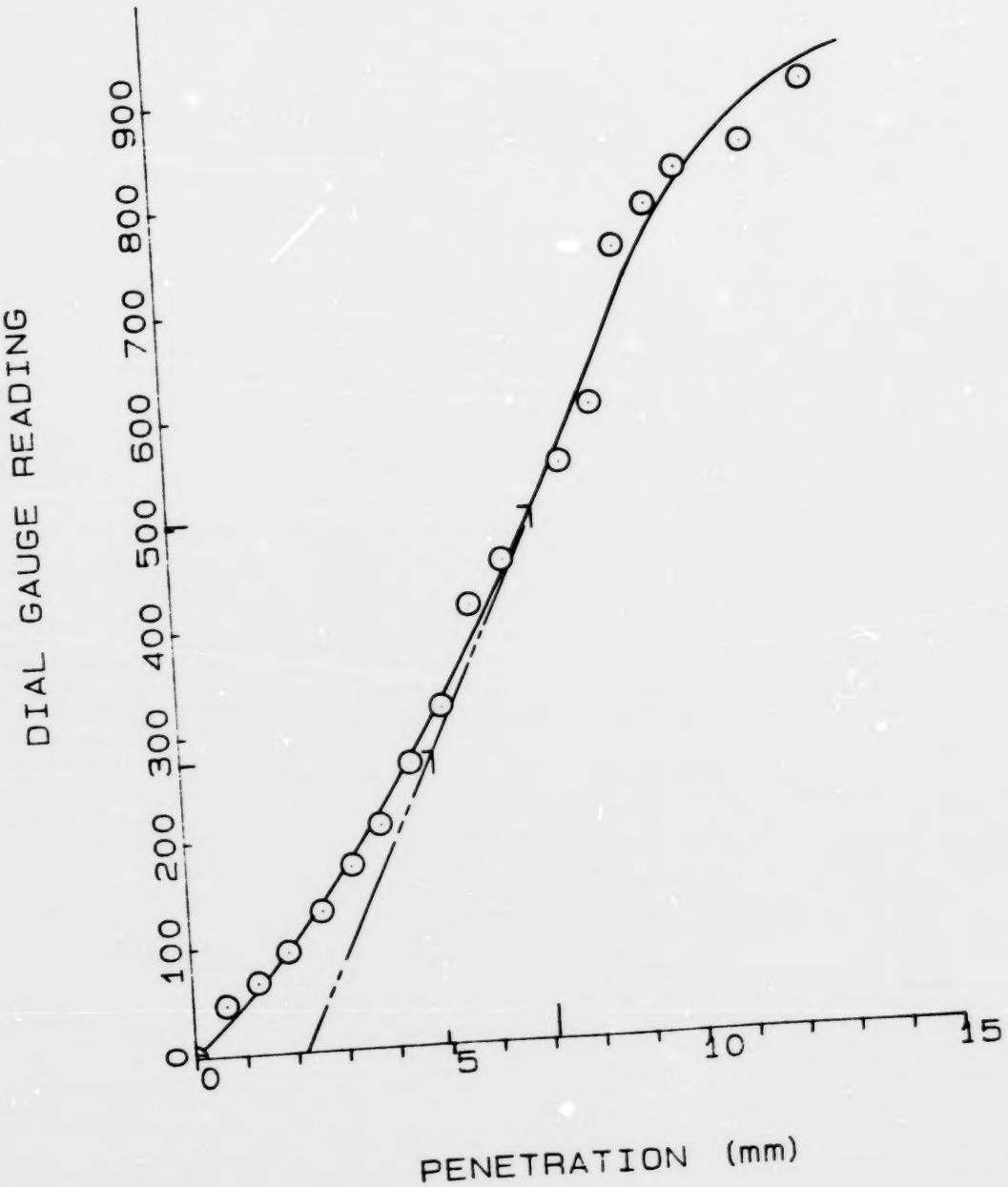
TEST#	1	2	3	4	5	6	7
PENETR'N							
0.0 mm	0001	0001	0000	0000	0000	0000	0000
0.64	43	4	3	5	11	32	15
1.27	65	7	5	11	32	71	35
1.90	92	14	8	22	70	135	64
2.54	130	28	11	39	105	204	98
3.18	171	47	15	56	141	270	140
3.81	209	66	18	78	188	348	194
4.44	267	94	23	105	223	424	250
5.08	318	129	30	144	278	515	319
5.72	413	-	37	281	320	600	391
6.40	455	220	43	220	372	690	478
6.98	-	264	52	360	420	758	543
7.62	545	315	61	310	473	840	625
8.26	600	372	70	350	526	910	STOP
8.89	748	424	82	390	580	988	
9.52	787	488	91	428	622	1050	
10.16	820	543	104	464	671	STOP	
11.43	843	660	116	520	752		
12.70	900	765	151	549	825		

APPENDIX B

GRAPHS #1 TO #7
CALIFORNIA BEARING RATIO TESTING
AT GREGG RIVER MINE

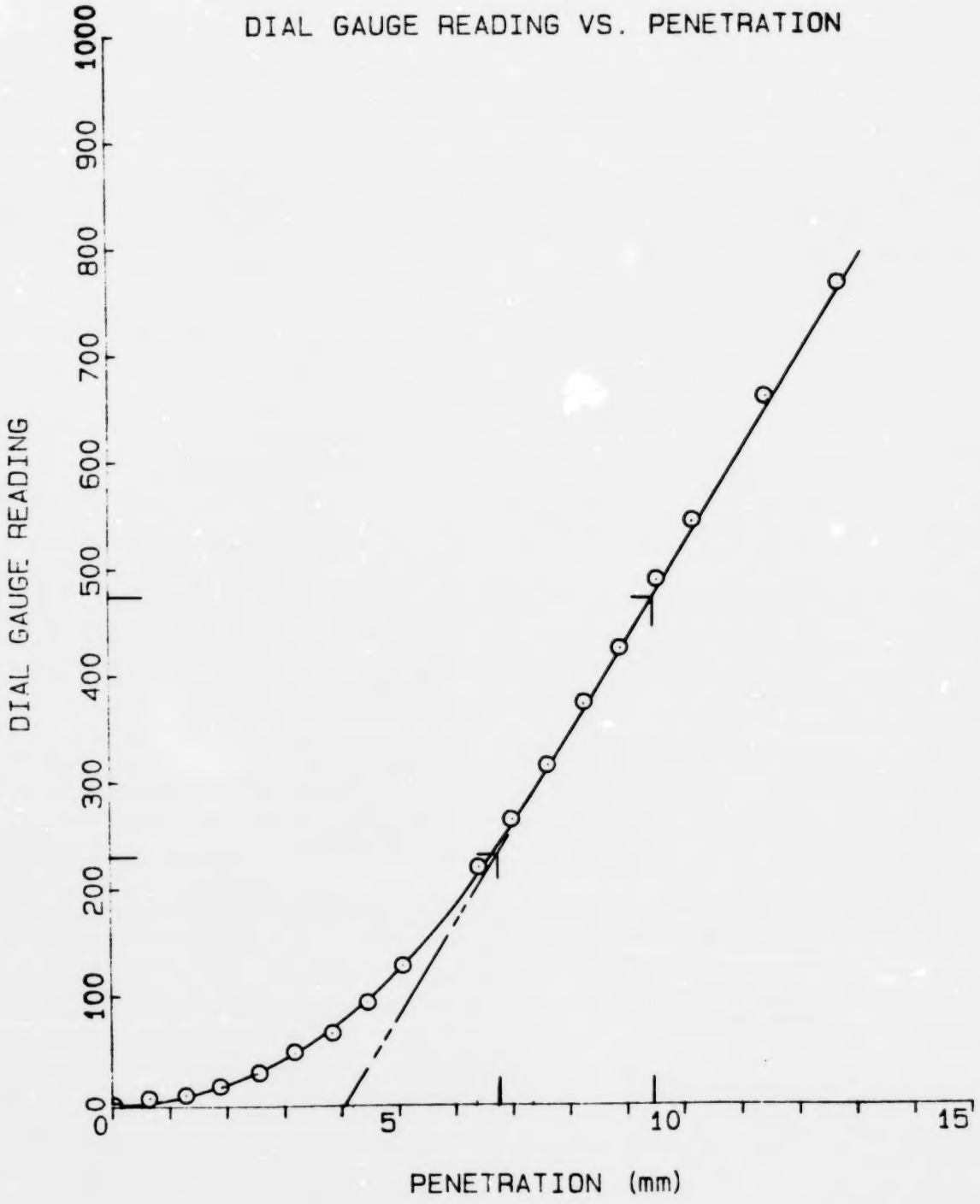
ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#1 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION



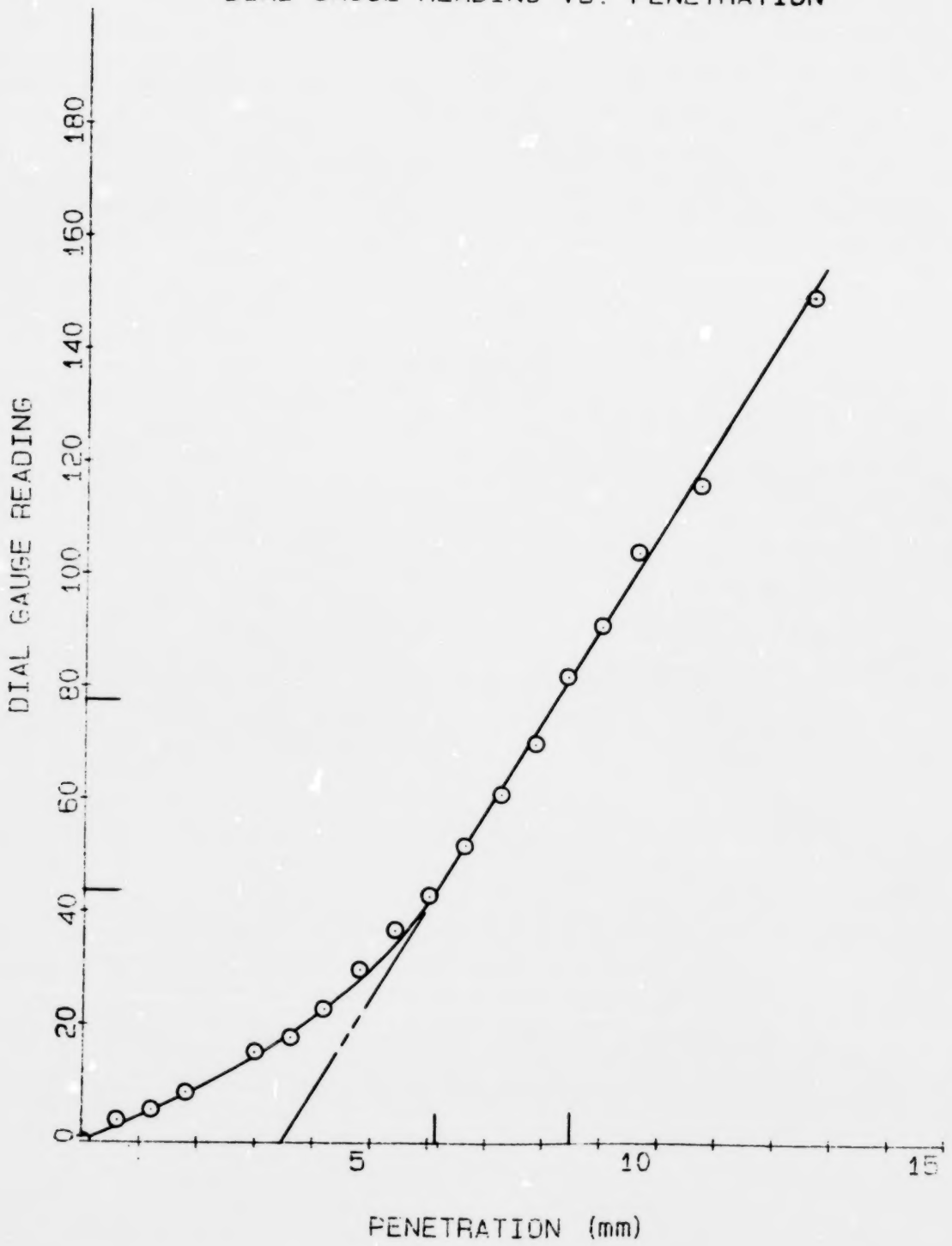
ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#2 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION



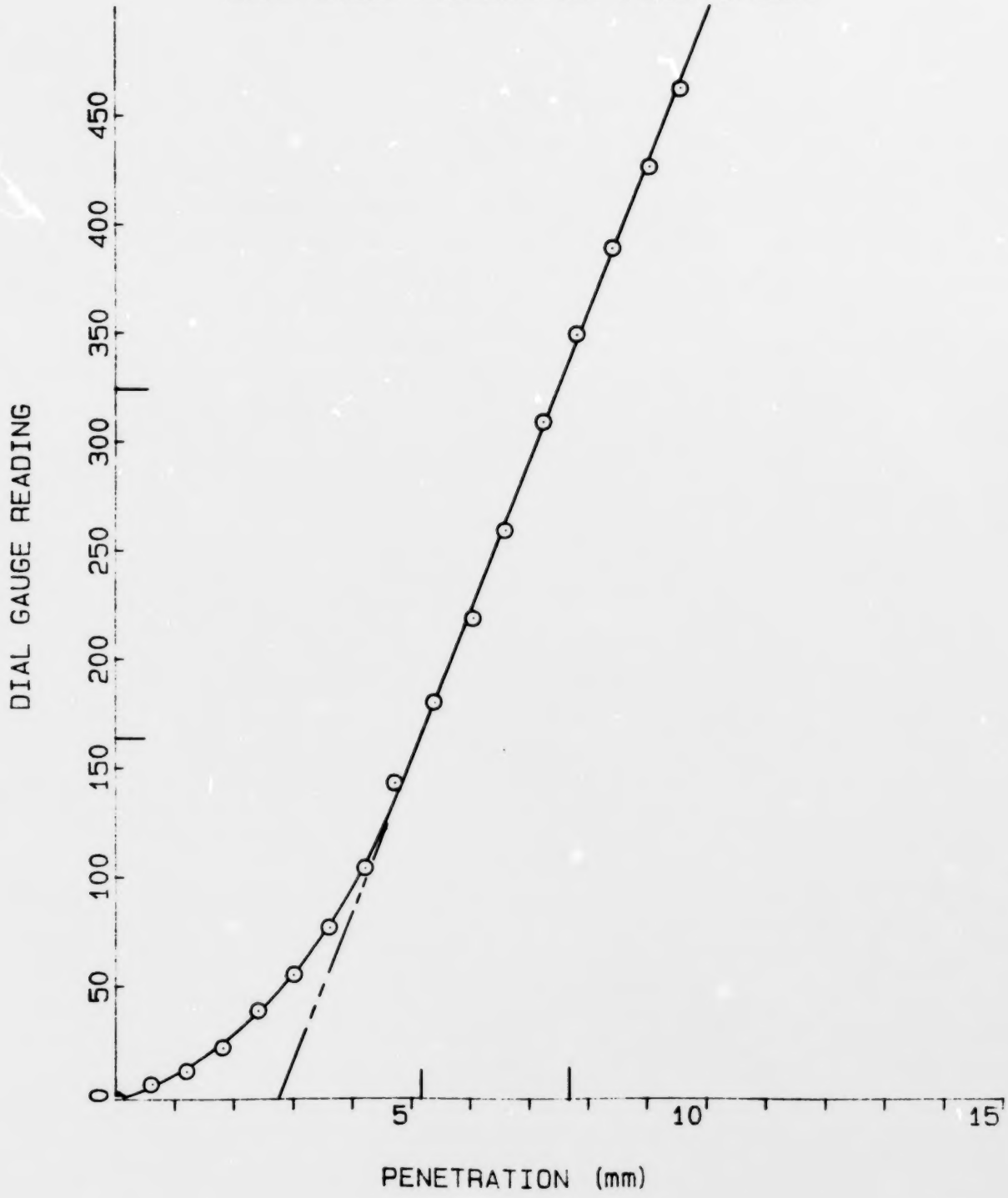
ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#3 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION



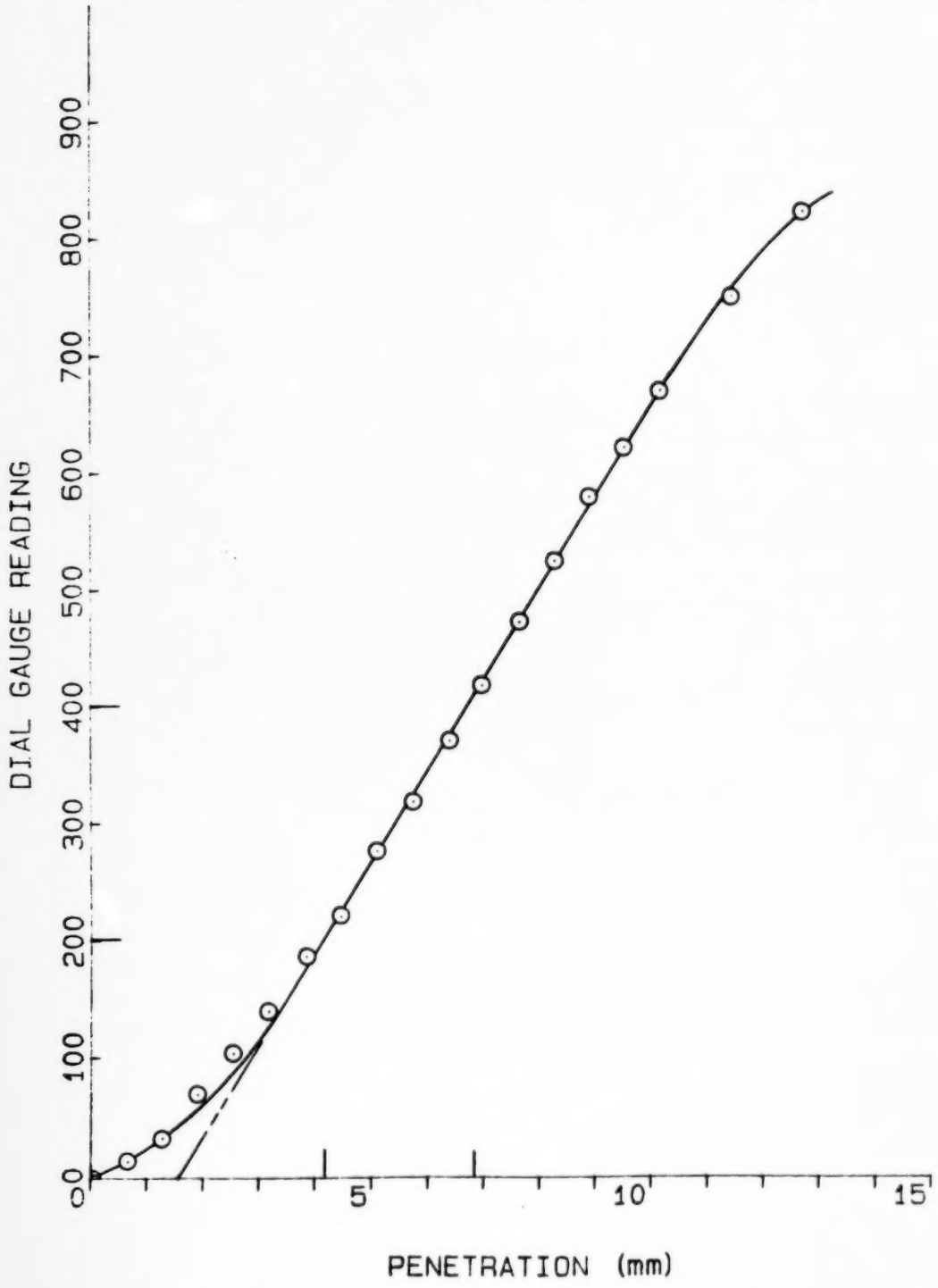
ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#4 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION

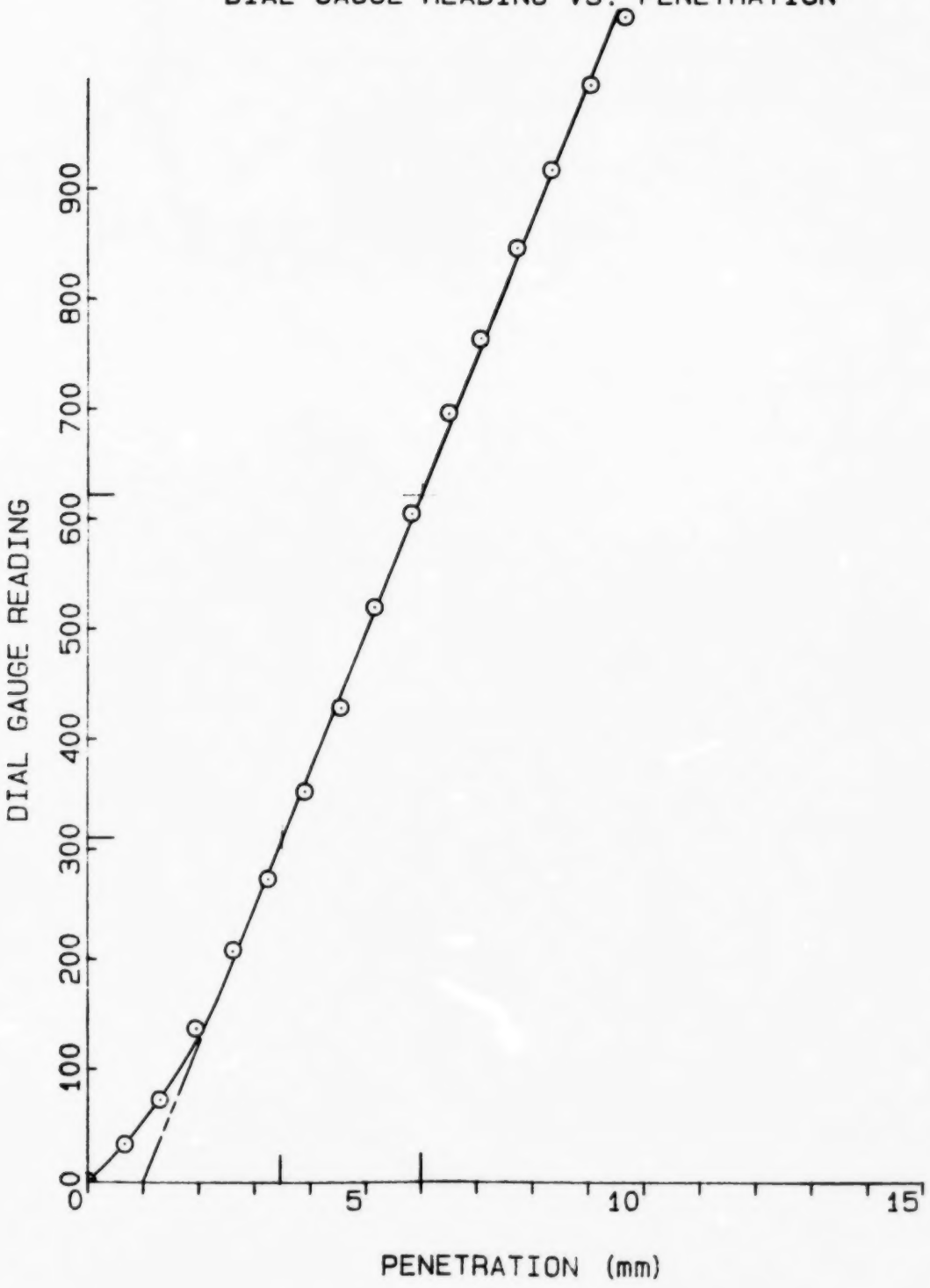


ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#5 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION

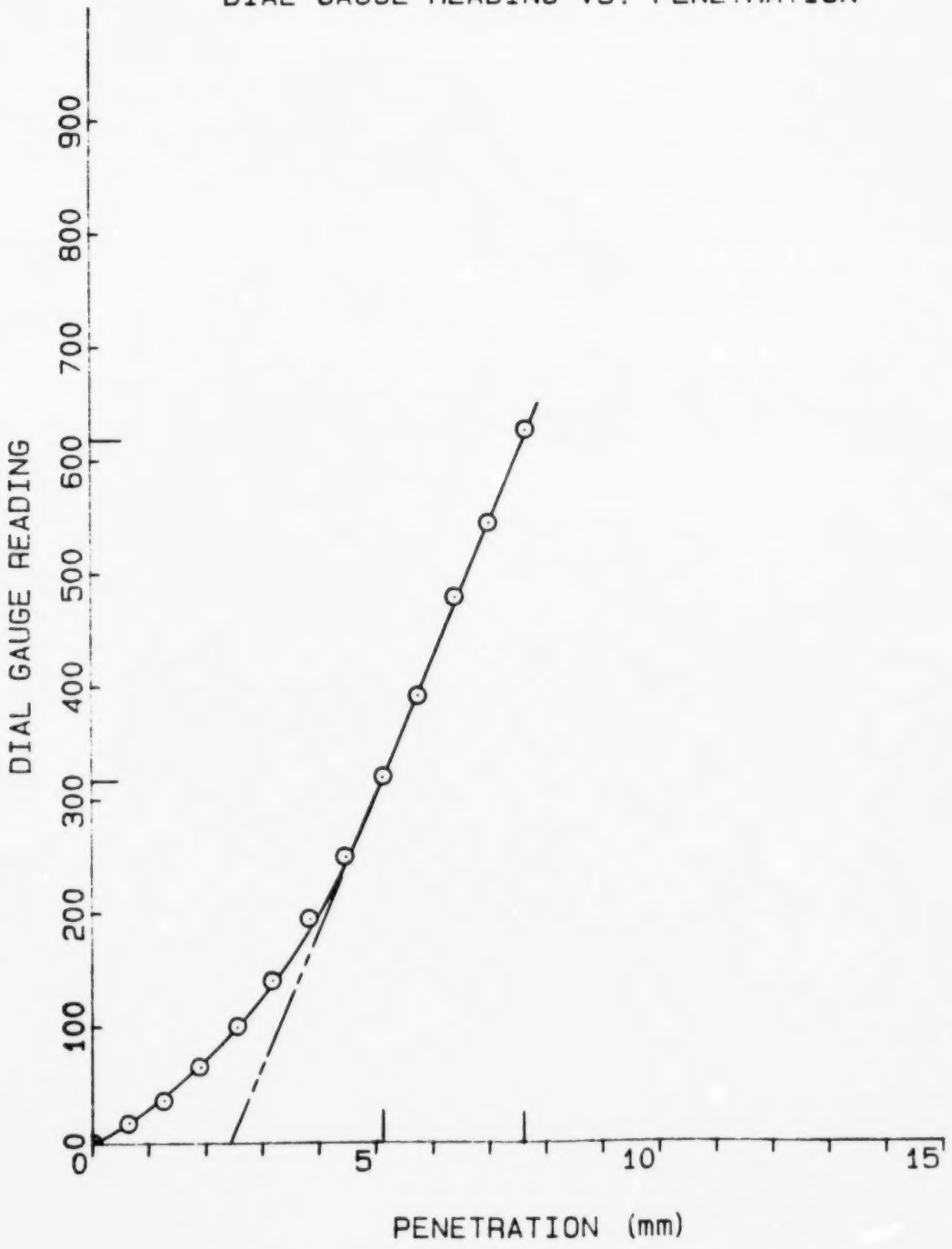


CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#6 PROVING RING: PR-20
DIAL GAUGE READING VS. PENETRATION



ROLLING RESISTANCE PROJECT CBR TESTING
CLIENT: Gregg River Resources Ltd. LOC'N: LM2 Pit
DATE: 27-MAY-87 TEST#7 PROVING RING: PR-20

DIAL GAUGE READING VS. PENETRATION



APPENDIX C

CALCULATIONS FOR CALIFORNIA BEARING RATIO TESTS

APPENDIX C

CALCULATIONS FOR CALIFORNIA BEARING RATIO TESTS

NOTE:

After having drawn the vertical lines from the 0.1* and 0.2* (2.54mm and 5.08 mm) penetration depths, two dial gauge numbers are substituted into one of the following conversion equations.

$X = 8.4436 * Y + 90.5571$ for the small ring PR-20
and $X = 32.9137 * Y + 179.821$ for the large ring PR-60,

where Y is the dial gauge reading in divisions,
and X is the force in Newtons.

TEST #1

Proving Ring PR-20, therefore use X = Y*8.4436 +90.5571

The 0.1* Dial Gauge Reading = 272, X = 2388 Newtons
and since the piston diameter was measured at 2.019 inches (51.28mm), the piston area, A_p = (PI/4.0)*(DIAMETER^2 = 2065.5 mm^2.
So the pressure,

$$P = (X / A_p) = (2388\ N / 2065.5\ mm^2) = 1.16\ MPa.$$

Dividing the pressure by 1000 p.s.i. (6.89 MPa), yields the 0.1 inch California Bearing Ratio,

$$CBR(0.1) = (P/6.89)*100\% = (1.16\ MPa/6.89\ MPa)*100\% = 17\%.$$

A similar procedure is used for the 0.2* Dial Gauge Reading. The reading is 504, which is 4347 Newtons.

$$P = 4347N/2065.5mm^2 = 2.10\ MPa,$$

Now the pressure is compared to 1500 p.s.i. (6.89 MPa *1.5), so the 0.2 inch California Bearing Ratio,

$$CBR(0.2) = (P/(6.89MPa*1.5))*100\% = 20\%.$$

The difference between the CBR(0.1) and CBR(0.2) values is approximately 17 percent. But since CBR(0.1) is less than CBR(0.2), the results are rejected.

The remaining six tests follow a similar procedure. All tests have been summarized in the table.

TEST #	1	2	3	4	5	6	7
0.1 RDG	272	236	43.8	164	202	311	318
X (N)	2388	2088	460.	1476	1801	2717	2776
P (MPa)	1.16	1.01	0.223	0.70	0.87	1.32	1.34
CBR(0.1)	17%	15%	3.2%	10%	13%	19%	20%
0.2 RDG	504	470	77.3	323	400	623	618
X (N)	4347	4060	743.	2818	3469	5351	5309
P (MPa)	2.10	1.97	0.360	1.36	1.68	2.59	2.57
CBR(0.2)	20%	19%	3.5%	13%	16%	25%	25%
DIFF'CE in CBR	17%	29%	15%	30%	28%	30%	28%
Accept/ Reject	REJECT	REJECT	REJECT	REJECT	REJECT	REJECT	REJECT

Note: All tests done with 2000 lb. capacity proving ring PR-20

APPENDIX D

OPERATION AND SERVICE MANUAL FOR CALIFORNIA BEARING RATIO TESTING

Supplied by Soiltest,Inc.

CN-725

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MODEL [illegible] BEARING RATION APPARATUS FIE

0484

SOILTEST ®M.R.

OPERATION AND SERVICE INSTRUCTIONS

HOSKIN SCIENTIFIC
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1. GENERAL

The CN-725 Field CBR Set is used for field in-place CBR tests in accordance with the California specifications.

A two-speed screw jack is included in the set for application of force to the penetration piston. Hydraulic type jacks are not suitable for CBR tests because of the pulsating effect of the jack. The screwjack has a speed of .0083 inch/revolutions (120/inch) on the high gear ration and a speed of .0028 inch/revolutions (360 revolutions/inch) on the low gear ration.

A three-speed screw jack, similar to that used by Corps of Engineers, is available separately at extra cost. The speeds of this jack at high, medium and low gear rations are respectively, .0138 inches/revolution (73 revolutions/inch), .0059 inches/revolution (170 revolutions/inch) and .0029 inches/revolution (360 revolutions/inch).

The data given in Table 1, the data form, the data curves and the picture are taken from "Instruction Report No. 1" published by Corps of Engineers, U.S.Army.

The CN-725 set consists of the complete equipment needed to perform the CBR test in the field. The items included are:

2. APPARATUS

The CN-725 set consists of the complete equipment needed to perform the CBR test in the field. The items included are:

Quantity	Model No.	Description
1	CN-410	Mechanical Jack & Swivel Head
1	PR-20	Proving Ring, 2000 lb. capacity
1	PR-60	Proving Ring, 6000 lb. capacity
1	CN-832	Field Penetrometer Piston

Quantity	Model No.	Description
1	CN-833	Extension Set
1	CN-886	Connector Set
1	CN-414	Bridge Support and Magnetic Holder
1	IC-8	Dial Indicator
1	CN-802	Circular Surcharge Weight, 10 lb.
1	CN-791	Slotted Surcharge Weight, 10 lb.
1	CN-790	Slotted Surcharge Weight, 20 lb.

Other simple accessories generally required are: simple containers for moisture and desity determinators, spatula, straight edge, digging tools, etc.

The attached drawing shows the CBR equipment assembly and the photograph shows a typical field set up.

For information on procedures to develop flexible pavement design curves that utilize California Bearing Ration (CBR) test results as a design variable, refer to Instruction Report 4 dated November 1959 "Developing a Set of CBR Design Curves" published by U.S. Army Engineer Waterways Experiment Station, Corps of Engineers, Vicksburg, Mississippi.

3. PROCEDURE

3.1 Prepare the surface to be tested by removing loose and dried material, leveling the test area as perfectly as practicable. Where nonplastic base materials are encountered, extreme care should be taken not to disturb the test surface. Spacing of the penetration tests should be such that operations at one point will not disturb the soil at the next point to be penetrated. This spacing may range from a minimum of 6 or 8 inches in plastic soils to 14 or 16 inches in coarse granular soils.

3.2 Locate the truck so that the center of the steel or aluminum I-beam on the rear end is directly over the surface to be tested. Install the test jack with swivel to underside of the beam. Place the truck jacks beneath the ends of the beam and lift the truck so that little or no weight rests on the rear springs and so that the truck is level across the back. The truck should be loaded sufficiently to give a reaction of about 7000 lbs. or somewhat greater than the weight required to force the penetration piston into the soil being tested.

3.3 Slide jack to correct position for test; connect proving ring to end of jack; connect piston adapter to bottom of proving ring; connect necessary number of extensions to come within 6 inches of the surface to be tested; connect penetration piston. Clamp jack in place, noting rod level mounted on jack to be sure assembly is plumb.

3.4 Place the surcharge plate beneath the penetration piston so that when the piston is lowered it will pass throught the center hole.

3.5 Seat the penetration piston under a load of approximately 3 psi, do not exceed 10 lbs. total. (For rapid setting use high gear ratio of jack.) For base materials with irregular surface, seat piston on the thinnest practical layer of fine limestone screenings (20-40 mesh) or plaster of paris. (Ordinary sand is too rounded and unstable to form a satisfactory seat for the piston.)

3.6 Raise surcharge plate while seating load is on piston and spread clean fine sand to a depth of 1/8 to 1/4 inch over the surface to be covered by the plate. This serves to distribute the weight of the surcharge uniformly.

3.7 Apply surcharge weights equivalent to the load intensity of material and/or pavement which overlies or will overlie the subgrade or base, except that the minimum weight applied should be made up of the 10 lb. circular steel plate plus one 20 lb. surcharge weight. This minimum weight creates an

intensity of loading equal to that created by the 10 lb. weight used in the 6 inch diameter CBR mold in the laboratory. A maximum of 90 lbs. surcharge will be used except in special tests such as on clean rounded sand, or other similar cases. Table 1 shows the computed surcharge weights.

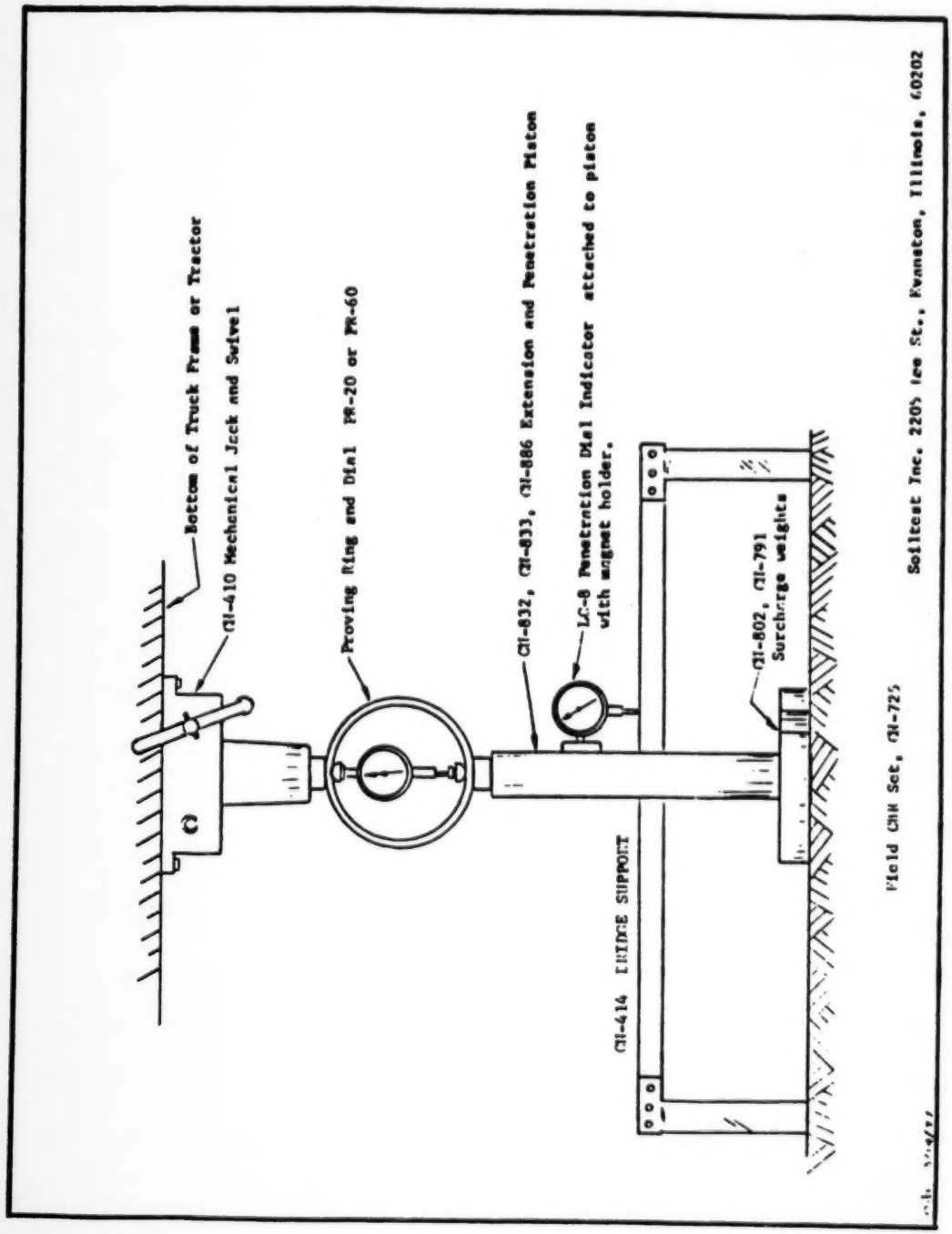
3.8 Attach the penetration dial clamp to the piston so that the dial rests upon the dial support.

3.9 Set the dial gages to zero.

3.10 Apply load to penetration piston so that the rate of penetration is approximately 0.05 (1.27 mm) inch per minute. By using the low gear ratio of jack during test, a uniform rate of penetration can be maintained by the operator. Record the deflection of the proving ring at penetration depths of 0.025 (.635 mm), 0.05 (1.27), 0.075 (1.905 mm), 0.1 (2.54), 0.125 (3.175), 0.15 (3.81), 0.175 (4.445), 0.20 (5.08), 0.225 (5.715), 0.25 (6.35), 0.275 (6.985), 0.30 (7.62), 0.325 (8.255), 0.35 (8.89), 0.375 (9.525 mm), 0.40 (10.16), 0.45 (11.43), and 0.50 (12.70 mm) inch. In homogeneous soils, penetration depths greater than 0.30 inch frequently may be omitted. Compute the bearing value in pounds per square inch and the CBR in percent. This work is simplified by working up proving ring calibration sheets to show CBR values directly for corresponding dial readings.

3.11 The corrected CBR value (see data sheet) should be determined at 0.1 inch and 0.2 inch penetration. The CBR usually selected is at 0.1 inch penetration. If the CBR at 0.2 inch penetration is greater than at 0.1 inch penetration, the test should be rerun. If check tests give similar results, the CBR at 0.2 inch penetration should be used.

3.12 At the completion of the test, obtain a sample at the point of penetration for water content determiniation. A density determination should also be made about 4 to 6 inches away from the point of penetration.


Bottom of Truck Frame or Tractor
CH-410 Mechanical Jack and Swivel
Proving Ring and Dial PR-20 or PR-60
CH-832, CH-833, CH-886 Extension and Penetration Piston
LC-8 Penetration Dial Indicator attached to piston with magnet holder.
CH-802, CH-791 Surcharge weights
CH-414 BRIDGE SUPPORT
Field CBR Set, CH-725
Soiltest Inc. 2205 Ice St., Evanston, Illinois, 60202

FIELD CBR TEST

1. Date _____ 19 ____

2. Project _____ 3. Project Location _____

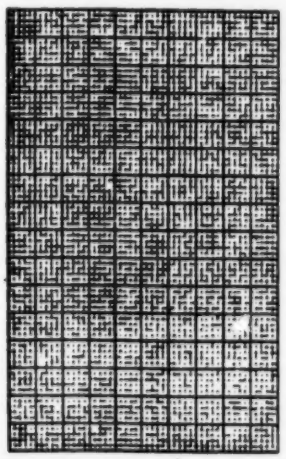
4. Test Location _____

_____ 5. Material _____

6. Depth, In. _____ 7. Failed / Unfailed 10. Proving Ring No. _____

8. Pene.	9. Dial	8. Pene.	9. Dial	8. Pene.	9. Dial
.025"		.175"		.325"	
.050"		.200"		.350"	
.075"		.225"		.375"	
.100"		.250"		.400"	
.125"		.275"		.450"	
.150"		.300"		.500"	

9. Dial



8. Penetration - Inches

CBR at 0.1"

11. Corrected Dial _____

12. CBR [____ %]

CBR at 0.2"

13. Corrected Dial _____

14. CBR = $\frac{____}{1.5}$ = ____ %

	15. Water Content for CBR	16. Water Content for Dens.	17. Density Sample
18. Container No.			
19. Wet Soil + Container			
20. Dry Soil + Container			
21. Wt Water			
22. Wt Container			
23. Wt Wet Soil			
24. Wt Dry Soil			
25. Water Content		[ ]	
26. "K" Factor			
27. Unit Wet Wt			
28. Unit Dry Wt			[ ]

29. Sand Volume

30. Wt Filled	
31. Wt Empty	
32. Wt Sand	
33. Vol. Container	
34. Calibrated Dens.	
35. Wt After	
36. Wt Sand	
37. Wt After	
38. Wt Sand	
39. Wt Sand Used	

40. Remarks _____

41. Field Test By _____ 42. Lab. Test By _____ 43. Comptd. By _____ 44. Chkd _____

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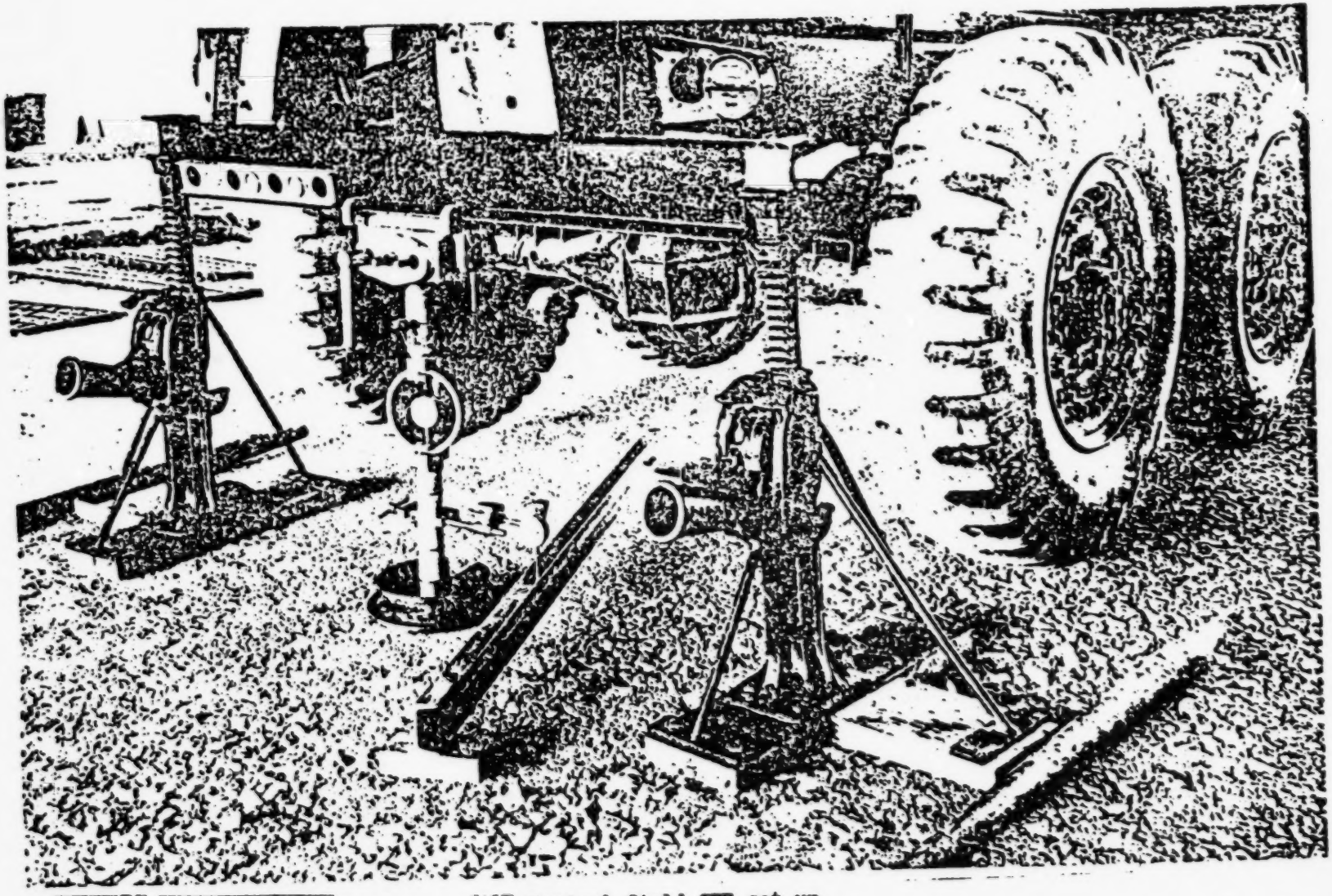


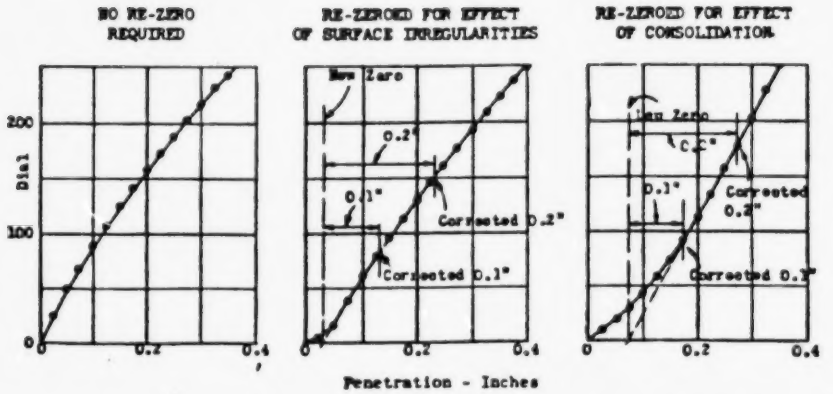
Typical field CBR set-up

Table 1

Computations of Surcharge Weights, Depth vs Density

Depth in.	Wet Density, lb/cu ft														
	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
4	15	15	16	17	18	19	20	21	22	23	24	25	25	26	27
6	22	23	25	26	28	29	30	31	33	34	35	37	38	40	41
8	29	31	33	35	36	38	40	42	44	45	47	49	51	53	55
10	36	39	41	43	45	48	50	52	55	57	59	61	64	66	68
12	44	46	49	52	55	57	60	63	65	68	71	74	76	79	82
14	51	54	57	60	64	67	70	73	76	80	83	86	89	92	
16	58	62	65	69	73	76	80	84	87	91	95	98	102	105	**
18	65	70	74	78	81	86	90	94	98	102	106	110	115	119	
20	73	77	82	86	91	96	100	105	109	114	118	123	127	132	
22	80	85	90	95	100	105	110	115	120	125	130	135	139	145	
24	87	93	98	104	109	115	120	126	131	136	142	147	152	158	
26	95	100	106	112	118	124	130	136	142	148	154	159	165	171	
28	102	108	114	121	127	134	140	146	153	159	165	172	178	184	
30	109,	116	123	129	136	143	150	157	164	170	177	184	191	198	

* 30-lb surcharge on surface and above line.
** 90-lb surcharge is maximum surcharge that will be used for ordinary test. In special cases additional weight may be needed, therefore surcharge weight up to 198 lb has been computed.



These curves show a case requiring no re-zeroing and two typical cases where re-zeroing is required. The curves themselves are not necessarily typical as the slope and shape of curves vary considerably. In general, the points should line up so that reasonable curves can be drawn with a French curve. Tests should be re-run where the points do not line up sufficiently well to permit drawing reasonable curves.